

Abstract

The present invention relates to patterning methods for patterning metal over a substrate, and more particularly to patterning methods using a die. A patterned die having at least one raised portion and having a metal layer over the die is pressed onto a thin metal film over a substrate, such that the metal layer over the raised portion of the patterned die contacts portions of the thin metal film. Pressure is then applied such that the metal layer and the thin metal film cold-weld to one another. The patterned die is removed, such that the portions of the metal layer cold-welded to the thin metal film break away from the die and remain cold-welded to the thin metal film over the substrate, in substantially the same pattern as the patterned die. In one embodiment of the invention, at least one layer is deposited between the substrate and the thin metal film, such as an organic layer or an adhesion-enhancing layer. In another embodiment of the invention, an adhesion-diminishing layer is positioned between the patterned die and the metal layer, to lower the adhesion between the metal layer and the die. The present invention further relates to devices formed using the above methods.